These data indicate that changes in thickness of the subchondral bone plate in post-traumatic osteoarthritis as modeled here develop in a biphasic manner, with initial thinning followed by subsequent thickening.

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THE RELATIONSHIP BETWEEN RADIOGRAPHIC MEASUREMENT OF JOINT SPACE WIDTH AND MRI MEASUREMENTS OF CARTILAGE THICKNESS AND VOLUME IN OSTEOARTHRITIC AND CONTROL KNEES

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Purpose: To explore the relationship between the radiographic measurement of joint space width (JSW) with the MRI measurement of cartilage thickness and volume in the medial femorotibial compartment (FTC) of normal and osteoarthritic (OA) knees.
Methods: 165 subjects from the Genetics, Artrosis and Progression study (GARP), with symptomatic familial OA at multiple joint sites, were followed for 2 years. Fixed-Flexion radiographs and 1.5 Tesla Magnetic Resonance (MR) images of the same knee were acquired at baseline and 2 years later. The Kellgren Lawrence grades (KLG) were determined by two experienced readers conservatively in consensus. 52 normal knees (KLG 0) and 113 knees with signs of radiographic OA (43 = KLG 1, 23 = KLG 2, 47 = KLG 3) were observed. Quantitative minimum Joint Space Width (JSW) of the medial femoro-tibial joint was measured with a computerized program (Holy's, Lyon, France). Quantitative measurements of cartilage thickness (CT) and volume (CV) of the weight-bearing regions of both the medial femoral condyle and medial tibial plateau were assessed on MR images using a proprietary computerized system (VirtualScopics Inc, Rochester, NY). For each subject, measurements from both the medial femoral condyle and medial tibial plateau compartments were combined to provide medial FTC measurements of the CT and CV.
Results: Baseline JSW and CT were smaller in knees with KLG 3 than in knees with KLG$<$3 ($p<0.0001$ and $p=0.04$, respectively). CV was not significantly different between KLG ($p=0.29$). Baseline JSW was correlated well with CT and CV ($R=0.68$, $p<0.0001$ and $R=0.55$, $p<0.0001$, respectively). In normal knees, the mean (SD) change from baseline in JSW, CT and CV was 0.04 ± 0.45 mm (NS), 0.06 ± 0.11 mm (NS) and 41 ± 110 mm^3 ($p<0.02$), respectively. In OA knees (defined as KL$>$1) the mean (SD) change from baseline in JSW, CT and CV was 0.21 ± 0.49 mm ($p<0.002$), 0.09 ± 0.19 mm ($p<0.0002$) and 120 ± 179 mm^3 ($p<0.0001$). JSW loss appeared to be better correlated with CV loss ($R = 0.49$, $p<0.0001$) than with CT loss ($R = 0.34$, $p<0.01$). The standardized response means for loss in JSW, CT and CV were 0.42, 0.47 and 0.67, respectively.
Conclusions: Radiographic measurement of JSW was well correlated with MRI measurement of cartilage thickness and volume. CV showed a better sensitivity to change in OA knees than JSW and CT at 2 years.

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PROGRESSION OF KNEE OSTEOARTHRITIS (OA) MEASURED BY MRI IMAGING OF CARTILAGE LESIONS IN A COHORT OF PATIENTS IMAGED BEFORE AND 3 YEARS FOLLOWING ARTHROSCOPY

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Purpose: Several studies have demonstrated that patients who undergo partial or total meniscectomy, and in whom OA is detected, have a high likelihood of progressive radiographically documented cartilage loss over subsequent years. We hypothesized that at 3 years post arthroscopy (PA) patients who had partial meniscectomy (PM) would have cartilage loss that could be detected by semi-quantitative scoring of MRI images.
Methods: Patients who had arthoscopic PM performed in 2002 were invited to undergo repeat MRI at 3.0T, to be compared with their preoperative 1.5T MRI, and then to undergo 2 additional 3.0T MRIs 6 and 12 months later, to evaluate progression of cartilage loss. Cartilage lesions were graded according to change in size and depth. The scoring method rates each of 17 anatomical compartments on a scale from 0 (normal) to 6 (full thickness cartilage loss). In each of 20 subjects and 17 regions, we dichotomized the data, recording whether or not the score worsened from surgery to first visit. We analyzed these data by an item response (Rasch) model with main effects for subject and region.
Results: There were 9 men (mean age 60.4, range (48.9,71.3)) years, and 11 women (mean age 63.5 range (49.5,79.6,) years in this cohort. Mean BMI was 28.5, range (20.2, 38.4). The mean time between pre-arthroscopy 1.5T MRI and baseline 3.0T MRI ranged from two to three years. Pre-arthroscopy cartilage lesion scores had median 0 (range 0-6) while baseline 3.0T scores had median 4 (range (0-6). Mean baseline CTX-II was 337.9, range (81.9,760.7) ng/(mmol Creat). The incidence rate pooled across compartments for cartilage loss between Pre-arthroscopy and baseline 3.0T visit was 39% (95% confidence interval [33%,44%]). We noted the number of compartments in which a subject had a worsened score (median 5, range (0-10) compartments). We found a significant positive association between this measure and the subject's BMI at first study visit. (regression slope 0.32, unit: (no of compartments)/(BMI), se=0.12, p=0.02). There was also a positive association between number of MRI compartments showing cartilage loss and baseline levels of urinary CTX-II (regression slope 5.45, unit: ng/(mmol Creat)/(no of compartments), se 33.0), although significance was not achieved with the limited number of subjects scored to date.
Conclusions: This pilot evaluation provides initial evidence that scoring of cartilage lesions in knee OA can detect loss of joint structure in a 3 year observation period. 3.0T MRI may provide more sensitivity to detect change in cartilage. The correlation of MRI cartilage loss with BMI and elevated CTX-II is consistent with previous studies of other knee OA cohorts at high risk of progressive cartilage loss and provides further validation of this method for detecting progression. This approach may be useful for assessing the efficacy of treatments that are potentially cartilage preserving.